# ARTICLE MOUNTING

This invention relates to the mounting of articles such as a camera in such manner that the article/camera is selectively rotatable about an axis.

In particular but not exclusively the present invention is concerned with the mounting of cameras in such manner as to assist in the stabilising of cameras during the use thereof by enabling the camera to be rotated or rolled about a predetermined axis.

Whilst the present specification will discuss the features of the invention and its mode of use in relation to the positioning of a camera it is to be understood that the apparatus and features of the invention can well be used in other applications in which it is desired to be able to displace an article in a similar manner.

It is well known to be able to mount cameras on tripods and other supports so that the camera can be rotated about an axis perpendicular to the optical axis of a lens associated with the camera and/or a second axis in which the lens axis is tiltable up or down thereby effectively to provide two degrees of pivotal movement relative to the optical axis of the camera.

It is an object of the present invention to provide a mounting system for a camera that allows the camera to be mounted to a support in such manner that the camera can be selectively displaceable relative to the support about at least one axis additional to the aforesaid two degrees of rotational movement.

Broadly according to an aspect of the invention there is provided an arrangement for mounting a camera in such manner that the camera can be supported at a location offset from the optical axis of the optics of the camera below its centre

of gravity by mounting means enabling rotation between the mounting means and a further support serving to support the mounting means, about a predetermined axis relative to said optical axis.

Preferably, said predetermined axis is definable by the positioning of the further support relative to the horizontal/vertical.

In accordance with a further aspect of the invention, an article/appratus/camera is eccentrically mountable by a mounting means supported by/from a support in such manner that the mounting means is adapted for relative rotation about a predetermined axis defined by the positioning of the main support with respect to the horizontal/vertical, the arrangement being such manner that in the event of said relative rotation a predetermined axis of the article/apparatus/camera effectively remains in its initial position.

Preferably, a camera is eccentrically mountable to a first main portion of a two main portion support unit in such manner that relative rotation between the two portions is possible about a predetermined axis or direction defined by the position of the second main portion aligning with the optical axis of the imaging arrangements of the camera, and also such that in the event of the relative rotation said imaging axis of the camera effectively remains in its initial alignment

Conveniently said support unit includes a first main support portion including an annular/cylindrical first cage/framework rotatable with respect to a second cage/framework, the first cage/framework including part of a geared drive for rotatably engaging with a part of the geared drive provided on a second cage/framework, and wherein said first cage/framework is adapted for eccentrically mounting the camera with respect to the axis of relative rotation between the first and second gages/frameworks

Preferably, the geared drive comprises a rack and pinion(s) configuration

In a preferred construction drive means are provided for producing said relative rotation.

Preferably said geared drive means includes an electric motor mounted on the second cage/framework, the motor being arranged to rotate a gear/pinion engaging with a tooth rack coaxial with said direction and provided upon the first cage/framework..

For a better understanding of the invention and to show how to carry the same into effect reference will now be made to the accompanying drawings in which:-

Figure 1 is a highly schematic side view of a first embodiment of a support assembly for supporting a camera unit in accordance with the proposals of the invention;

Figure 2 is a front view of a camera unit when mounted in the support assembly of Figure 1.

Figure 3 is a side view of a schematically represented second embodiment a support assembly for supporting a camera unit,

Figure 4 is a front view of a camera unit when mounted in the cage assembly of Figure 3;

Figure 5 schematically illustrates a variation of a detail of the embodiment of Figures 3 and 4

The embodiment of the cage assembly 1 shown in Figures 1 and 2 includes first and second circular frame members 2 maintained in parallel spaced apart relationship by spacer bars 3, The bars 3 are located externally of the circular form of the frame members 1 and 2 in mounting lugs 4. In practice, there are six

such lugs 4 equiangularly spaced around the circumference of the frame members 1 and 2. This construction provides a cylindrical like cage or framework.

The inner periphery of each frame member 2 provides a smooth cylindrical track 5 for receiving and locating in rolling contact rolls 6 provided upon an inner circular camera unit mounting frame 7. One or both of the frame members 2 incorporates a toothed circumscribing track 8 that is intended to be operationally engaged by a pinion 9 associated with the mounting frame 7. In practice the pinion can be rotated by way of a motor drive schematically represented at 10 whereby the frame 7 can be rotated with respect to the frame 2.

As may be seen from Figure 2 a camera unit 11 to be carried by the rotatable mounting frame is mounted to the frame in such manner that the centre of gravity of the camera is, i.e., in the position shown in the Figure 2, located below the axis of rotation of the camera unit within the cage assembly frame 2. The camera unit 11 can be considered as comprising the actual camera, together with any batteries, monitors etc., associated with the camera, that are conveniently mountable to the frame 7 whilst any other apparatus conventionally regarded as forming a camera unit can be located elsewhere. Thus, for example, a monitor could be supported from the frame assembly 7 or from a post like support which mounts the above discussed support assembly. whereby the monitor remains in conventional operational position irrespective of the setting of the cage assembly 1.

The support assembly 1 is provided with a mounting arrangement 12 whereby the assembly can be mounted upon a camera equipment support, not shown in Figures 1 and 2 but to be discussed herein after. It is convenient to note at this point that camera equipment supports include column like supports known as body mounted camera stabilisers and usually gimballed at the centre of gravity thereof by a gimbals arrangement that includes to a support arm that can in turn be attached to a operator worn apparatus support harness or vest. Such devices are intended,

when supporting a camera, to isolate the camera (or similar device) from unwanted movements of a walking, running or otherwise moving operator particularly when the camera is being used in the motion picture and video industries.

In order to enable the assembly to be hand carried the assembly is provided with a carrying handle 13 connecting with the two uppermost bars 3.

As will be seen from the Figures 1 and 2 the camera unit 11 is thus eccentrically mounted within the support assembly 1 in such manner that relative rotational/rolling displacement is possible between the support assembly 1 and the camera unit 11 about a predetermined axis or direction (in the case of a camera unit with the optical axis of the camera unit lens) in such manner that in the event of rotation of the support assembly 1 about said axis the camera unit 10 effectively remains in its initial position.

This arrangement has the practical consequence that whenever the support assembly frame 2 is rotated about its axis of symmetry the camera support frame 7 and the camera unit 11 supported thereby will roll, or can be caused to roll under the control of electronic, electrical or mechanical control equipment (not shown) relative to the cage assembly 1 as to maintain the orientation of the camera with respect to the horizontal unchanged. In other words the horizon for the camera will remain level.

With this arrangement the camera horizon can be maintained horizontal irrespective of the nature of the mounting of the cage assembly to an associated support (not shown).

Referring now to Figures 3, 4 and 5 in which a second embodiment of the assembly of the invention shown therein includes first and second circular end frame members 14. Each frame member 14 includes an outer ring element 15

and a coaxially arranged inner ring element 16, the elements 15 and 16 being rotatable relative to each other, .

For the purpose of facilitating such relative rotation the facing relatively rotatable surfaces of the elements 15 and 16 can be provided with appropriate coating material (not shown) to facilitate such relative rotation. Alternatively, rolls (not shown) may be provided on one or both of the co-operating ring element pairs 15 and 16 to facilitate such rotation.

As will be seen particularly from Figure 4 the ring elements 15 are each provided with a series of apertures 19 and slots 20 regularly spaced there around the peripheral regions thereof.

Selected ones of these apertures 19 serve as mounting locations for a number of parallel bars 21 (Figure 3) that serve to couple the outer ring elements 15 one to the other to form a rigid cylindrical open outer cage. For example, six or eight such bars 21 can be equiangularly disposed around the associated outer ring elements 15. It will be appreciated that the number of the bars 21 used would depend upon factors such as the overall dimensions and diameter of the elements and this the cage assembly and its intended use.

The two inner ring elements 16 likewise provided with a plurality of equidistantly spaced apertures 23 (Figure 4) there being shaped bosses 24 in the vicinity of each such aperture 23. The two inner ring elements 16 are interconnected as will be discussed hereinafter effectively to provide a rigid inner cage relatively rotatable within the outer cage.

In practice since this inner cage is to be required to support/carry an article such as a camera the mounting arrangements for such article are, as will be considered hereinafter are utilised to interconnect the inner ring elements to provide the inner cage.

An outer annular ring plate 25 (Figure 3) is mounted to the outer face of one of the outer ring elements 15 (for convenience this particular ring element will be referred to herein after as the front ring element) by suitable bolts or the like 26 engaging with appropriate ones of said bores. The ring plate 26 includes a peripheral toothed rack 27 on its inner annular face (only schematically illustrated), the rack thus being coaxial with the axis of relative rotation of the associated inter engaging inner and outer ring elements 15 and 16. A toothed pinion 28 mounted to the shaft 29 of a motor (not shown) carried by the inner ring 16 by way of bolts 30.

In the variation shown in Figure 5 The ring plate 25 includes a peripheral toothed rack 31 on its outer annular face, the rack 31 thus being coaxial with the axis of relative rotation of the associated inter engaging inner and outer ring elements 15 and 16.

This rack 27 is intended to be operationally engaged by two gear wheel/pinions 32/33 respectively carried by the output shafts 34/35 of electric motors (not shown in Figure 5) mounted from support brackets (not shown) integral with the inner ring element 16 associated with said front ring element 15, the motors being held in place by bolts 36. In practice the motors are additionally supported along the lengths thereof by secondary support brackets (not shown) located midway of the length of the motor and connecting with two of the bars 21 serving to interconnect the two inner ring elements 16 by being connected to such elements by engagement with appropriate ones of the apertures.

Immediately opposite to the locations of the motors a camera support platform 37 is mounted to the inner rings 16 such the platform 37 effectively bridges the rings 16 and effectively forms part of the construction of the inner cage.

The support platform 37 is secured to the ring elements 16 by bolts or the like (not shown) engaging with selected ones of the apertures in the rings. It will be understood that the plane of the support 37 is essentially in a plane tangential to the inner cage assembly. The support includes a dovetail camera connection facility 38 adapted for engagement with a complementary dovetail attachment fitting provided upon the post type of camera support to be discussed herein after. This arrangement enables mounting and removal of the camera from the inner and outer cages. It will be understood that means are provided for securely locking the camera unit 11 to the support assembly

The outer cage is provided with a assembly support/mounting platform (not shown). This platform is connected to the outer cage by bolts (not shown) engaging in selected ones of the apertures 19. It will be appreciated that the platform would be suitably apertured/adapted to facilitate the mounting of the platform and thus the associated assembly to for example a a travelling camera unit incorporating power supplies for the camera unit 11 and motor 16.

From the above it will be noted that that the camera unit 21 is effectively eccentrically mounted to the assembly of the inner and outer cages. An important feature arising from such mounting is that, As may be seen from Figure 3 that the centre of gravity of the camera unit 21 is, i.e., when in the position shown in the Figure 3, located below the axis of rotation of the camera frame within the cage assembly.

By associating the control of the above mentioned motor(s) with a gyro-system in such manner as to provide an electrical control fed back loop serving as a breaking facility for the pinion enables the cage assembly to be mounted at any angle whilst enabling the operational horizon of camera unit 10 to remain horizontal/level.

In addition the braking facility can be used to control any tendency of the support frame 7 and the camera unit 11 mounted thereto from undergoing rocking motion.

It will be understood the a motor drive system (not shown) can be used to effect a controlled rotation of the pinion and thus the camera mounting frame with respect to the support assembly. With this arrangement the camera mounting frame and the camera can be rotated/rolled relative to the support assembly cage even when the latter is static so that, in practice the effect of, for example, a rocking movement i.e., being at sea or banking around corners.

It wll be appreciated that the the above described support assembly can be mounted to any convenient form of support and can form part of a camera mounting installation For example, the above discussed support assembly can provide part of a so-called remote head for mounting from tripods, boom arms, cranes etc., in such manner as to be suitable for use as to provide a third axis of positional displacement of a camera or with a view to keeping a horizon level and stable. For this purpose the remote head would incorporate arrangements facilitating stabilisation.

Furthermore the support assembly can be constructed such as to be mountable to so-called camera stabilising platforms. Certain of such platforms are known as 'Steadicams' or Sled-platforms.

Whilst the above description has referred to the mounting of the camera within a generally cylindrical cage that is rotatable within an outer cylindrical cage it will be appreciated that this is but one mode of supporting the camera for rotation/rolling about a predetermined axis. For example, the camera could be effectively mounted to a support bar or suitably sized and shaped support element comprising platform/plate member or structure that is mounted for rotation in a

second support member, structure or the like so shaped and arranged such that the camera is rotatable about an axis coaxial or offset aligned with the optical axis of the optics of the camera. It will be appreciated that in order to achieve this arrangement the support for the platform would need to be shaped and formed to accommodate the physical dimensions i.e., depth of the base of unit beneath the optical axis.

As has been mentioned the above described assembly can be mounted upon a column type support unit. In a preferred such support unit provision is made for adjustable level mounting of the camera and any associated arrangement as herein before mentioned.

Thus according to a further aspect of the invention there is provided an adjustable level article support unit for a camera support assembly as herein before mentioned including telescopically engageable elongate post sections including a main post section section and at least two further post sections that are adapted to be independently positionally set with respect to opposite ends of the main post section.

According to a further aspect of the invention an adjustable level article support unit includes telescopically engageable sections including a main section and at least two further sections that are adapted to be independently positionally settable with respect to opposite ends of the main section.

Preferably, the telescopic arrangement is such that variation in the length of the support unit is possible from opposite ends of the main section, and wherein positionally adjustable means are provided for supporting the adjustable level support unit from the main section is provided upon the main section.

According to a still further aspect of the invention an adjustable level article support unit includes a first post section, a second post section adapted at one end

thereof to mount an article to be supported and its other end telescopically to inter-engage into one end of the post section, a third elongate post section adapted at one end thereof telescopically engage in the other end of the post section and a fourth post section adapted at one end telescopically to engage in the other end of the third post section and at its other end to unit support element or to means for supporting a load therefrom, and gimbals means located intermediate of the ends of the first section for enabling the support unit itself to be manually whilst permitting pivotal movement between the support means and the unit elongate post sections.

Preferably the diameters of the the first and second post sections are such as to allow the third post section telescopically enter into the second post section when the latter is fully telescopically engaged into the first post section from a direction opposite to that of the second post section into the main post section so as to facilitate as short as possible fully telescoped relationship between the post sections.

For a better understanding of the invention and to show how to carry the same into effect reference will now be made to the accompanying drawings in which:

Figure 1A schematically illustrates an adjustable level article support unit incorporating the concepts of the invention when in an extended article support setting.

Figure 2A schematically illustrates an article support unit of Figure 1 when in its minimum length setting;

Figure 3A illustrates to an enlarged scale the telescopic elements used in the support unit of Figures 1 and 2,

Figure 4A in exploded view details of a lower end fitting for locking the telescopic sections in a required relative position;

Figure 5A illustrates in exploded view details of two forms of end fittings for enabling the position of post sections and for attachment of the support unit to a support or other article;

Figure 6A illustrates in exploded view details of a lower end fitting for locking the telescopic post sections in a required position; and

Figure 7A illustrates in combined plan and elevation a further detail of an end fitting for the mounting of a camera to the uppermost telescopic post section.

Referring now to the drawings and more particularly to Figures 1A and 2A the adjustable level support unit 1 shown therein includes a main/first post section 2 adapted at its upper end 3 telescopically to receive the lower end 4 of a second post section 5. The upper end 6 of the post section 5 is provided with an end fitting 7 by means of which the article to be supported i.e., a camera or the like 8 can be connected to the platform 7 for the purposes of use. This end fitting will be discussed hereinafter

A rotatable clamp element 9 is provided at the upper end 3 of the first post section 2 for the purposes of locking the second post section 5 at a required lengthways position with respect to the first section 2. This clamp unit 9 is adapted for exerting a clamping action upon the outer surface of the post section 4 that telescopically engages there with and will be further discussed hereinafter.

The lower end 10 of the first post section 2 is provided with a connection element 11 by means of which a third and fourth telescopically engageable post sections 12 and 13 respectively are connectable in extension of the post sections 2 and 4. This connection element 11 will be discussed hereinafter

The upper end 14 of the of the third post section 12 is adapted to connect with the connection element 11.

A rotatable clamp element 15 is provided at the lower end 16 of the third post section 12 for the purposes of locking the fourth post section 13 at a required lengthways position with respect to the third post section 12 This clamp unit 15 is conveniently similar to that provided at the lower end 10 of the first post section 2. The lower end 16 of the fourth post section 13 is adapted to receive a adapter unit 17 whereby the assembly of the four post sections 2,4, 12, and 13 can be connected to a base unit 18 in such manner that the assembly of the four post sections is upstanding from the base unit. Alternatively apparatus associated with the operation of the camera unit may be connected to the lower end of the bottom post section 13.

Articles can be carried from the post sections as is indicated in the Figures. As shown one such article is carried from an arm 22 connected to a clamping unit 23 provided upon the section 12. In the Figures the arm is shown connected to the third section 12. With this arrangement it should be noted that when the four sections are telescoped to the position shown in Figure 3A clamping unit 23 for the arm can be positioned at the lower end of the associated section.

When the support unit is intended to be part of a user body mounted stabilisation device the the support unit is carried from a support harness or vest (not shown) worn by the user of the camera by way of a gimbals unit 19 incorporating a carrying handle 20.

This gimbals unit 19 includes a sleeve 21 having at its upper end a mounting 22 for a pivoted handle structure that is pivoted to the the mounting 22. The mounting 22 allows the post to rotate about the longitudinal axis of the support unit and is mounted to the outermost section 2 at a position that is effectively at the centre of balance of the support when carrying the camera and any other form

of load such as is indicated in the Figures. The sleeve is locked in a required position lengthways of the post section 2 by a locking ring 23.

Referring now to Figure 4A this illustrates in detail the attachment unit 11. The latter includes a sleeve part 24 that is engageable with the lower end of the post section 2. The lower end of the sleeve comprises a ring of 'fingers' 25 that are clamped towards the post section 12 by a clamping ring 26.

The connection unit 15 is illustrated in the the upper part of Figure 5A and includes a sleeve part 27 attached to the lower end of the post section 12 and having a clamping part 28 extending therefrom adapted to be able to clamp against the post section 13 on rotation of a locking element 29. and Figure 5A and includes a sleeve part 28 having at its The lower part of Figure 5A illustrates the base member 18 and as shown comprises ring member 18 at the lower end of the post section 13 and intended to threadably engage with an upstanding threaded part provided upon an article it is required to attach to the lower end of the post section 13. The element 9 is schematically illustrated in Figure 6A and includes a sleeve member 30 secured to the upper end of the post section 2 that is provided with 'fingers' that are caused to clamp against the post section 5 by means of a clamp ring 31 with its locking element 32.

The platform 7 can comprise a sleeve secured to the upper end 6 of the post section 5 having a threaded part which enables a camera or other article to be secured to the post section. This sleeve can provide for the mounting of the platform previously mentioned..

It will be understood with the above discussed adjustable support unit that lengthways telescopic adjustment is possible from opposite ends of the main post section 2. In practice this means that the level of the article/camera mounted to the platform 7 relative to the carrying gimbals/handle 19,20,21 can be set to suit the convenience of the user.

The figures illustrate the mounting of such additional articles to the support unit at the lowermost end thereof as shown at 24.

It will be understood with the above discussed adjustable support unit that lengthways telescopic adjustment is possible from opposite ends of the main section 2. In practice this means that the level of the article/camera mounted to the platform 7 relative to the carrying gimbals/handle can be set to suit the convenience of the user and that if it should be desired to mount the support unit to an actual base support such as a camera stabilising platform. (Such stabilising platforms are known under trade names such as 'steadicam' and sled platforms) the settings of the telescopic sections 12 and 13 can be set so that the camera 8 when so mounted is at a required level. As will be appreciated with this arrangement the camera remains level wise set for user carrying use upon removal from the stabilising platform without the need for resetting adjustments.

The additional articles can be elements such as batteries for the camera, monitors for enabling communication between the user of the support unit and a remote source of information relevant to the use of the camera.